DETERMINANTS OF MOBILE PAYMENT USAGE AND THE MODERATING EFFECT OF GENDER: EXTENDING THE UTAUT MODEL WITH PRIVACY RISK

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ABSTRACT

Mobile payment is an emerging and important application for e-commerce and traditional offline commerce. This study investigates the determinants of the intention to use mobile payment services (MPS) and the extent to which these relationships are moderated by gender. For this purpose, a conceptual model is proposed by extending the UTAUT model with perceived risk. Data are from a web-based survey conducted using South Korean consumers ($n = 528$). Structural equation results reveal that performance expectancy and social influence have a positive effect on the intention to use MPS, whereas privacy risk has a negative effect. Gender was found to moderate two paths in the model, such that a high level of facilitating conditions increased the intention to use MPS for males but not for females, whereas privacy risk decreased the intention to use MPS for females but not for males. Theoretical and managerial implications for researchers and marketing practitioners are also discussed.

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1. INTRODUCTION

Providing payment services can create strong consumer experiences in retailing,[1] as consumers suspend or postpone purchases if they experience over-information, over-selection, or delays during the payment process.[2] Among various payment methods, mobile payment services (MPS) are gaining considerable attention, not only in e-commerce but also in brick-and-mortar retailing[3,4]. MPS can make the payment process more convenient for consumers, eliminating the need to carry or use a physical credit card or cash[5].

While the adoption rate of MPS is growing rapidly, research shows that the frequency of using MPS (less than two times a month on average) and the amount of payments (below USD 50 a month) are still moderate.[6] According to the Bank of Korea, the most preferred payment method by South Koreans is credit card, followed by cash and debit card; to date, the preference for MPS is not high. In the United States, MPS is still in an initial market stage due to the slow pace of its diffusion[7, 8]. The rate of MPS adoption is much lower than for any other task performed using a mobile device, particularly compared with mobile information search.[9] However, the payment stage of the shopping process is integral to every transaction, thus making it worthwhile to investigate its specificities[3].

The most reported reason for not using MPS is consumer concern about personal information leakages[7,8]. With MPS, consumers can make payments quickly and easily; at the same time, however, there is a risk that detailed data related to the purchase will be collected and analyzed for unexpected purposes[10,11]. Further, extant research suggests a significant gender difference in the perceptions on online privacy and acceptance of innovative technologies.[12] Previous studies on MPS acceptance and use mostly focus on perceived usefulness and ease of use, being based on technology acceptance theories. However, considering payment method characteristics, it is necessary to investigate the effect of a privacy risk as an MPS use determinant.

Therefore, the purpose of this study is to investigate the factors that influence intention to use MPS via an extended unified theory of acceptance and use of technology (UTAUT) model and reveal whether these relationships are moderated by gender. This study contributes to the

literature in several ways. First, by adding a perceived privacy risk variable to the already existing UTAUT model, we expand the discussion on MPS usage as an ambivalent service with both benefits and risks. Second, by examining the moderating effect of gender, rarely discussed in previous MPS studies, we enhance the understanding of the different responses to MPS by consumer groups.

2. LITERATURE REVIEW

2.1 Mobile Payment Service

Mobile payment, which uses mobile devices (e.g., mobile phone, smart-phone, or personal digital assistant) and wireless communication technologies (e.g., mobile telecommunications networks or proximity technologies), is an alternative payment method for goods, services, and bills/invoices[13]. For instance, Pousttchi[14] described MPS as a "payment service performed from or via a mobile device."

The MPS works as follows: The consumer mobile device becomes a security token that generates a random code for each transaction. Mobile devices allow users to connect to a server, perform authentication and authorization, make the mobile payment, and subsequently confirm the completed transaction[15]. Although some authors refer to mobile payment and banking as equivalent[16], these are distinct services in terms of the system process and number of players involved. While mobile banking entails a simple, direct consumer-bank relation, a mobile payment is a three-party process involving the customer, merchant, and bank[5]. The focus of this study is exclusively on mobile payments, based on the definitions and distinctions presented above. Table 1 summarizes MPS types and characteristics most commonly used worldwide and in Korea.

Table 1. Characteristics of major MPS

Name	Availability	How to use it	How it works
Android Pay (Global no. 1)	Any device with the app	• Tap-and-go • Send money via app or email	• NFC • Bluetooth
Apple Pay (Global no. 2)	Only iPhone	• Fingerprint and tap-and-go • Online purchase	• NFC
Kakao Pay (Korean no. 1)	Any device with the KakaoTalk app	• Enter password via app	• Only online via smartphone
Samsung Pay (Korean no. 2)	Only Samsung Galaxy	• Fingerprint and tap-and-go	• NFC • Magnetic fields

Several studies have focused on MPS adoption factors, primarily on the technology acceptance model (TAM), with additional constructs adapted for the study of mobile payments, such as cost, trust, mobility, expressiveness, convenience, speed of transaction, use situation, social reference groups, facilitating condition, the attractiveness of alternatives, and technology anxiety[11,13,17,18,19]. These studies considered MPS a new technology and mostly overlooked its system characteristics.

With contactless payments using near-field communication (NFC) technology-enabled devices, MPS has evolved dramatically over the past few years. To adopt mobile payment services, users have to evaluate the uncertainty and risks related to technology adoption. Recent studies have analyzed the use of MPS and indicated the need for better understanding of the determinants of MPS adoption and/or continued usage in terms of risks and user resistance[10,11,16].

2.2 Unified Theory of Acceptance and Use of Technology

UTAUT was developed by Venkatesh et al.[20] to predict the user adoption of information technologies. UTAUT integrates eight theories, including the theory of reasoned action (TRA), TAM, innovation diffusion theory (IDT), motivational model, theory of planned behavior (TPB), a model combining TAM and TPB, model of PC utilization, and social cognitive theory (SCT) [21]. Through empirical analysis, Venkatesh et al.[20] identified performance expectancy, effort expectancy, social influence, and facilitating conditions as the main factors determining user adoption. Among them, performance expectancy is most closely related to the perceived usefulness of TAM, which means the extent to which users believe performance can be improved by using a new system. Effort expectancy corresponds to the perceived ease of TAM use and is defined as the degree of ease in using a system. Social influence refers to the degree of awareness of the belief that important individuals around the user should use a new system. Facilitating conditions are the degree to which one believes a system can systematically and technically support the use of a new system.

Additionally, UTAUT suggests moderators such as gender, age, experience, and voluntariness of use from the perspective of social psychology. These moderating variables could thus help address inconsistency and the weak explanatory power of prior models and further explain the behavioral differences between different types of consumers.[20] The UTAUT model has around 70% explanatory power, which is 20%–30% higher than that of TAM and typically explains 40%–50% of the user's intention or usage behavior[20]. Therefore, numerous researchers studying the acceptance of users toward new technologies used UTAUT.

UTAUT has also been introduced in a variety of studies related to the mobile commerce field, where technology changes and new products and services are rapidly emerging. Particularly, several studies verified independent variables in mobile shopping[22], mobile banking[23], and mobile credit cards[24].

For MPS, Oliveira[5] found that performance expectancy and social influence are the most significant determinants of mobile payment adoption in Portugal, while Slade et al.[25] extended the existing UTAUT model by adding more consumer-related constructs, innovativeness, risk, and trust variables. Consequently, performance expectancy, social influence, innovativeness, and perceived risk were found to have a significant effect on nonuser MPS acceptance. Koenig-Lewis et al.[26] developed a research model by adding perceived enjoyment and knowledge to UTAUT. Empirical analysis revealed that perceived usefulness, perceived enjoyment, social influence, and knowledge have a significant positive effect on the intention to use MPS, while perceived ease of use had no significant effect. In Teo et al.'s[27] study, which incorporated trust in the UTAUT model, performance expectancy, effort expectancy, facilitating conditions, and trust were identified as significant factors in the intention to use MPS.

Numerous studies on financial technologies, such as mobile payments, mobile cards, and mobile banking, have confirmed the validity of the UTAUT model[25,27]. Therefore, the following hypotheses are proposed to examine the effect of each independent variable in the UTAUT model on the intention to use MPS:

H1. Performance expectancy has a positive effect on the intention to use MPS.

H2. Effort expectancy has a positive effect on the intention to use MPS.

H3. Social influence has a positive effect on the intention to use MPS.

H4. Facilitating conditions have a positive effect on the intention to use MPS.

2.3 Privacy Risk

In the online environment, privacy concerns have been consistently raised. For instance, Hérault and Belvaux[28] argued that users' privacy concerns are a major deterrent for the acceptance of technology-related products and services, and privacy risks reduce the perceived convenience of technology. Consequently, especially for MPS, there are increasing concerns about privacy[17]. Unlike personal computers, mobile devices are

personal and portable. Therefore, it is possible for vendors to collect more personal information than in a PC environment, and the collected information may be more private. Additionally, information about mobile devices is more likely to identify the consumer[29]. These characteristics of the mobile environment thus raise consumers' awareness of the possibility their privacy and personal information could be violated.

In recent studies, consumers' perceived privacy risk has been reported to reduce the acceptance and use of MPS[3,10,11]. Particularly, among the various risks that negatively affect the acceptance of MPS, privacy risk has been found to be the most influential factor carrying a psychological risk[30]. In using MPS, consumers reported concerns about privacy and security due to authentication and confidentiality issues as well as risks to secondary use and unauthorized access to payments and user data[11]. Despite the increasing popularity of MPS, according to an Inside Secure Survey of American Consumers, consumers focus more on payment fraud, privacy, and identity theft than the benefits of using MPS. Mallat's[31] qualitative research also revealed that privacy risk is the greatest impediment to consumers' use of MPS. Further, privacy risk has been reported to have a negative impact on the formation of positive attitudes toward MPS, ultimately increasing resistance to it[32].

In line with these finding, the following hypothesis is proposed:

H5. Perceived privacy risks have a negative effect on the intention to use MPS.

2.4 Moderating Effect of Gender

For the UTAUT model, Venkatesh et al.[20] suggested that gender moderates the relationship between intention to use new technology and the variables of performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy is more influential for the male group and effort expectancy and social influence for the female group.

In addition to the UTAUT model, gender is used as a key moderator in numerous consumer behavior and technology usage studies[33]. For example, Sun et al.[12] found that males are more inclined to adopt banking technologies than females. In an exploratory study on mobile commerce, Yang et al.[34] also found that gender influences the perceived ease of use and usefulness but negatively, contrary to expectations. Additionally, in a study of gender differences in MPS use, the effect of attitudes toward MPS acceptance intention was moderated by gender[35].

Recent studies have also revealed gender differences in the perception of privacy risk and its effects. For instance, Hoy and Milne[36] found that females are more concerned about privacy risks than males, whereas males pay more attention to effectiveness than females in using social network service. Taddicken's[37] study also showed that female users are more concerned with online privacy than male users and are reluctant to disclose sensitive information. Mao et al.'s[38] study on location-based services identifies that the higher the perceived privacy risk by females, the lower the positive word of mouth on services, while the perceived risk by males did not have a significant effect on word of mouth.

On the other hand, there is the argument that there are no gender differences in technology acceptance. The moderating effect of gender was not significant in studies on online shopping intentions,[39] mobile commerce acceptance intentions,[40] and NFC mobile credit card acceptance.[41] These results suggest that the moderating effect of gender in technology acceptance may be different depending on the study subjects or independent variables.

This study proposes the following hypotheses based on the UTAUT model, including the moderating effect of gender and the previous research findings that privacy risk is generally moderated by gender.

H6a. Gender moderates the relationship between performance expectancy and the intention to use MPS.

H6b. Gender moderates the relationship between effort expectancy and the intention to use MPS.

H6c. Gender moderates the relationship between social influence and the intention to use MPS.

H6d. Gender moderates the relationship between facilitating conditions and the intention to use MPS.

H6e. Gender moderates the relationship between perceived privacy risks and the intention to use MPS.

The research model and hypotheses are shown in Figure 1. Based on the UTAUT model, the privacy risk is included as an independent variable and gender is a moderating variable.
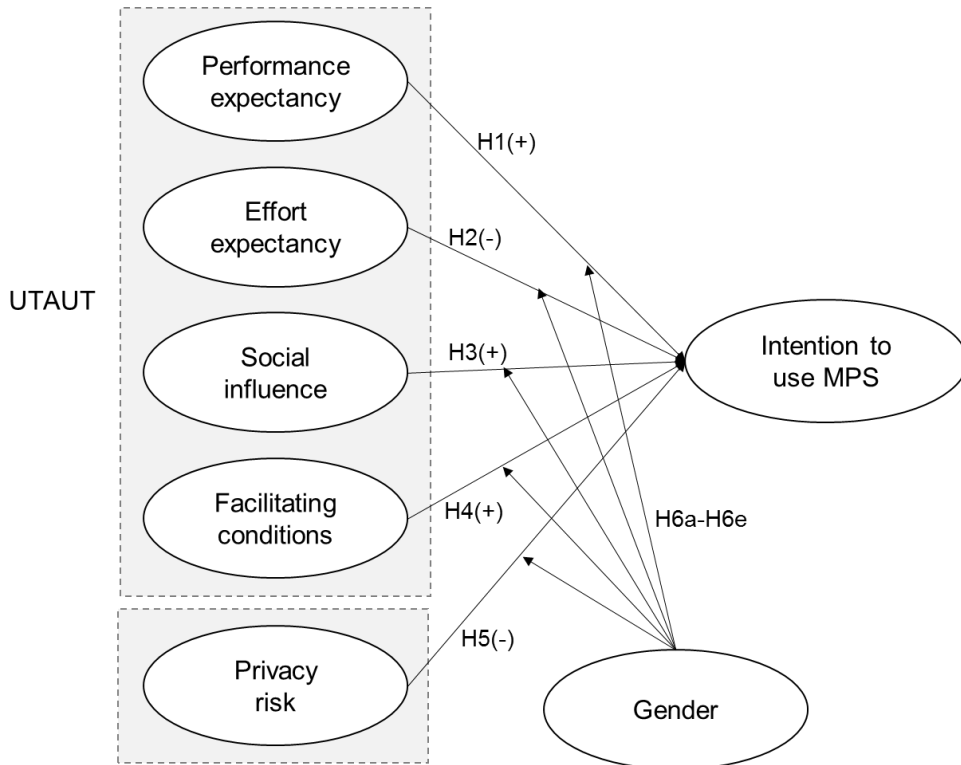
Figure 1. Research model

3. METHOD

3.1 Measurements

The research model includes six constructs. To ensure the validity of all instruments, each construct was measured with multiple items, and all were adapted from previous research and modified to fit our MPS context. All items were measured on a five-point Likert scale, with anchors ranging from "strongly disagree" (1) to "strongly agree" (5). Twelve items adapted from Venkatesh et al.[20] were used to measure the four constructs of the UTAUT model: consumers' perceived level of performance expectancy, effort expectancy, social influence, and facilitating conditions for using MPS. The four items used to measure privacy risks were adapted from Yang et al.'s[34] study on the perceived risk in MPS. The measures for the intention to use MPS were adapted from Oliver[42] and included intent to use, to increase use, and to recommend MPS. The individual items used in the questionnaire are provided in the appendix.

3.2 Sample and Data Collection

The sample is composed of South Korean consumers aged 20 to 49. As a result of its developed ICT infrastructure, Korea is a leading country in applying advanced technologies to the commercial field. Koreans are well suited to be subjects in this study because the technology environment for mobile payments is well established nationwide.

Data were collected in two steps: a pilot and a main survey. The pilot test of the survey instrument was conducted with 42 undergraduate students to establish its reliability and clarify wording. Following careful consideration of respondent feedback, scale reliability was tested, and sentences were amended to ensure a clear meaning. The main survey was conducted using a self-administered online questionnaire during April 7–10, 2016. Participant recruitment and data collection were conducted by Embrain (www.embrain.com), a professional online survey company. To test for differences by gender, quota sampling was performed for both males and females. A total of 580 sets were collected, and, after excluding 52 samples who responded that they "don't know anything about mobile payment," the remaining 528 were used for the analysis. Table 2 shows the general characteristics of the sample.

Table 2. Demographics of the respondents ($n = 528$)

Variables	Classification	Frequency	Percentage
Gender	Male	253	47.9
	Female	275	52.1
Age	20–29	211	40.0
(Mean = 32.43)	30–39	207	39.2
	40–49	110	20.8
Monthly income	< USD 1,000	182	34.5
(Mean = USD	USD 1,000–3,000	167	31.6
2,654)	> USD 3,000	179	33.9
Education level	High school (below)	73	13.8
	University student	90	17.0
	Graduate	314	59.5
	Master (above)	51	9.6
Occupation	Employee	235	44.5
	Self-employed	66	12.5
	Student	116	22.0
	Housewife	62	11.7
	Other	49	9.3

3.3 Data Analysis

PASW 20.0 software was used for the descriptive statistics, correlation analysis, and reliability test. For hypotheses testing, the study employed a structural equation model (SEM), including the measurement model, structural model, and multiple group analysis using AMOS 20.0. Fit indices were used to determine if the hypothesized model's fit with the sample data: chi-square, comparative fit index (CFI; fit if $\geq$ 0.90), Tucker–Lewis index (TLI; fit if $\geq$ 0.90), root mean square residual (RMR; fit if $\leq$ 0.50), and root mean square error of approximation (RMSEA; fit if $\leq$ 0.80).[43]

4. RESULTS

4.1 Validity and Reliability Results

The internal consistency of each construct in the model was tested using Cronbach's alpha. The results show that all Cronbach's alpha values were above 0.70, indicating the constructs employed in the model are reliable[44]. To test the validity of the scales, confirmatory factor analysis (CFA) was performed. The measurement model shows a strong fit between the data and model (χ^2 = 63.80, df = 19, p < 0.001). Several common indices (CFI = 0.983, TLI = 0.971, RMR = 0.034, RMSEA = 0.062) were examined, and the results suggested an adequate goodness of fit[43]. Convergent validity was evaluated using three criteria (Table 3): (i) all standardized factor loadings for an item are statistically significant and above 0.60[43]; (ii) all composite reliability (CR) values are above 0.70[43]; and (iii) all average variance extracted (AVE) values are above 0.50[45].

Finally, discriminant validity was assessed by analyzing the overall correlation between the constructs and squared root of AVE, which should exceed the correlations between each construct and all other constructs.[45] The results in Table 4 show the overall correlations among the variables as stable, and the analysis of the squared root of AVE confirms satisfactory discriminant validity.

Table 3. Results of confirmatory factor analysis

	Item	Factor loading	t	AVE	CR	Cronbach's alpha
Performance expectancy (PE)	PE1	0.838	-	0.623	0.990	0.824
	PE2	0.833	20.847			
	PF3	0.688	16.625			
Effort expectancy (EE)	EE1	0.801	-	0.712	0.993	0.876
	EE2	0.902	23.085			
	EE3	0.826	20.968			
Social influence (SI)	SI1	0.768	-	0.662	0.987	0.851
	SI2	0.858	18.932			
	SI3	0.814	18.337			
Facilitating conditions (FC)	FC1	0.837	-	0.640	0.989	0.836
	FC2	0.745	18.114			
	FC3	0.814	19.964			
Privacy risk (PR)	PR1	0.701	-	0.613	0.992	0.855
	PR2	0.914	18.480			
	PR3	0.852	17.902			
	PR4	0.632	13.559			
Intention to use MPS (IU)	IU1	0.851	-	0.770	0.993	0.906
	IU2	0.942	28.202			
	IU3	0.836	24.127			

Table 4. Discriminant validity and correlations

Constructs	PE	EE	SI	FC	PR	IU
PE	**0.789**					
EE	0.679[**]	**0.843**				
SI	0.363[**]	0.342[**]	**0.813**			
FC	0.570[**]	0.637[**]	0.389[**]	**0.800**		
PR	0.044	0.047	-0.158[**]	-0.024	**0.782**	
IU	0.512[**]	0.463[**]	0.491[**]	0.466[**]	-0.202[**]	**0.877**

Note: [**]$p < 0.01$.

Diagonal elements (bold figures) are the squared roots of AVE, and off-diagonal elements are the correlations among the constructs. To ensure discriminant validity, diagonal values should be greater than the off-diagonal ones.[45]

4.2 Structural Model Testing

The structural model was assessed using SEM, in AMOS 20.0; the results indicate an adequately fitting model (χ^2 = 337.313, p < 0.001, df = 137, CFI = 0.967, TLI = 0.946, RMR = 0.028, RMSEA = 0.053). As shown in Table 5, an examination of the standardized structural paths reveals that performance expectancy (β = 0.316, p < 0.001) and social influence (β = 0.309, p < 0.001) have a positive effect on intention to use MPS, whereas privacy risk (β = -0.170, p < 0.001) has a negative effect. However, effort expectancy and facilitating conditions had no significant influence on the intention to use MPS. These results support H1, H3, and H5 but not H2 and H4.

Table 5. Results of the structural model

Structural Path	β	t	p	Result
H1. PE → IU	0.316***	4.26	< 0.001	Supported
H2. EE → IU	0.068	0.87	0.380	Not supported
H3. SI → IU	0.309***	6.36	< 0.001	Supported
H4. FC → IU	0.099	1.49	0.134	Not supported
H5. PR → IU	-0.170***	-4.35	< 0.001	Supported

Note: *** p < 0.001.

Fitness statistics: χ^2 = 337.313, p < 0.001, df = 137; CFI = 0.967, TLI = 0.959, RMR = 0.028, RMSEA = 0.053.

4.3 Testing the Moderating Effect of Gender

To examine the moderating effects of gender in the adopted SEM model, a multigroup analysis approach comparing males and females was used. To test the invariance of the model parameters across the two gender groups, nested comparisons of constrained models were performed. Table 6 presents the results of model comparisons by chi-square differences. A comparison between Models 2 and 1 showed a nonsignificant chi-square difference (p = 0.098), supporting the invariance of these parameters across males and females. Subsequently, Model 3, in which all structural weights were constrained, was compared with Model 2. The addition of constraints on structural paths lead to a significant chi-square difference (p = 0.037), suggesting that at least one of the structural weights varies across gender.

Table 6. Invariance tests

Model	χ^2	df	CFI	RMSEA	$\Delta\chi^2(\Delta df)$	p
Model 1. Unconstrained	482.868	274	0.966	0.038		
Model 2. Measurement weights	501.478	286	0.964	0.038	18.61(12)	0.098
Model 3. Structural weights	513.331	291	0.963	0.039	11.85(5)	0.037*

Note: $^*p < 0.05$.

As shown in Table 7, facilitating conditions had a significant positive effect on the intention to use MPS for males ($\beta = 0.196$, $p = 0.019$) but not for females ($\beta = -0.046$, $p = 0.682$). By contrast, the privacy risk had a significant negative effect on the intention to use MPS for females ($\beta = -0.229$, $p < 0.001$) but not for males ($\beta = -0.074$, $p = 0.163$). The critical ratios for parameter differences confirmed the two model paths significantly differ across genders. These effects are depicted as solid lines in Figure 2. Therefore, H6d and H6e are supported but not H6a, H6b, and H6c.

Table 7. Comparison of structural relationships across gender

Path	Male		Female		C.R.
	β	t	β	t	
H6a. PE → IU	0.360**	3.273	0.371***	3.516	1.103
H6b. EE → IU	0.063	0.533	0.087	0.907	0.367
H6c. SI → IU	0.279***	4.130	0.337***	4.916	0.965
H6d. FC → IU	0.196*	2.337	-0.046	-0.409	-1.651*
H6e. PR → IU	-0.074	-1.398	-0.229***	-4.260	-2.668**

Note: * p < 0.05, ** p < 0.01, *** p < 0.001.

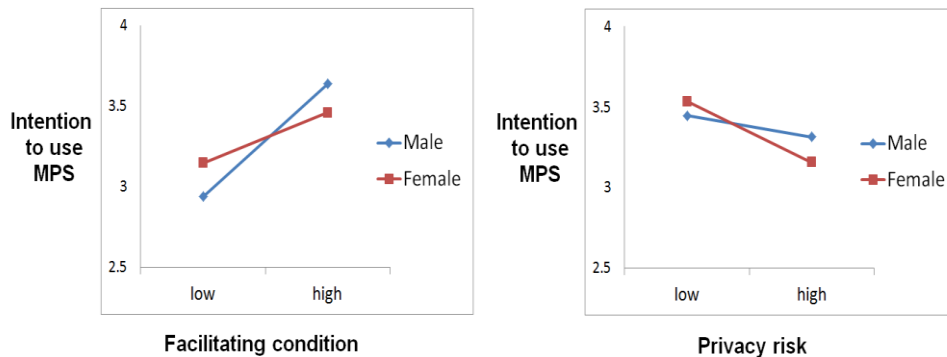C.R.: Critical ratios for differences between parameters.

Figure 2. Moderating effect of gender

5. DISCUSSION AND IMPLICATIONS

As MPS continues to be developed using new technologies, such as NFC and fingerprint recognition, and MPS providers (e.g., Apple Pay, Samsung Pay, and Android Pay) are promoted, it is expected that the use of MPS will become more common.[46] However, for MPS to completely replace existing payment methods, it is necessary to eliminate the various obstacles in the process of expanding MPS toward continuous use after adoption. This study investigated the factors affecting consumers' intentions to use MPS by extending the UTAUT model through focusing on privacy risks. We also revealed the moderating effect of gender on the relationships among variables. The empirical findings have some theoretical and practical implications.

First, it was confirmed that performance expectancy and social influence had a positive effect on the intention to use MPS. These findings are in line with previous studies suggesting that the usefulness of a technology or social environment to users may affect MPS acceptance[11,13,16,47]. This implied that promoting the function and convenience of MPS should be important aspects in consumer communication. Particularly, the intention to use MPS can be influenced by consumers' experience using MPS or by recommendations from others. Therefore, retailers and MPS operators should develop strategies to promote the benefits of MPS not only to individual consumers but also other stakeholders who may affect them.

Nonetheless, the effects of effort expectancy and facilitating conditions on the UTAUT model were not significant in this study. As high-level

technologies are widely applied to everyday life, the effect of effort expectancy was often not significant in previous studies[25,26]. However, it is noteworthy that the effect of facilitating conditions, which means retaining resources or knowledge related to the use of MPS, was found insignificant. This result reflects the characteristics of Korea's MPS environment. Samsung Pay, which is mainly used in Korea, is typically installed when a Samsung smartphone is purchased, so there is no need for extra effort from users. Kakao Pay also works with the messenger app that most Koreans use, so users can install and use it with only with a few clicks. Because MPS can be used with little effort and knowledge, unlike other technologies, the usability of the service and its social influence are more influential factors on consumers' use.

Second, the results showed that the added variable of privacy risk had a negative effect on the intention to use MPS. The UTAUT model has been extended in various studies, in combination with other concepts and theories[16,25,48]. Recently, there has been growing interest in the effects of the perceived risks of users for technology acceptance. However, most of these studies have limitations in integrating various types of risks into a single concept and measuring their influence[25,49]. In an empirical study on the acceptance of MPS, it was proposed that consumers could perceive various risks such as social, temporal, psychological, and privacy, but all risk types were integrated into one variable[25]. In this respect, this study contributes to a more complete understanding of consumers' MPS usage by extending the UTAUT model by focusing on privacy risk. Furthermore, in practice, the results highlight that retailers and MPS operators should not overlook consumers' perceptions of privacy risk when using MPS. The development of reliable, secure technologies and policy efforts to protect personal information would lower consumers' perceived privacy risks and contribute to a more stable and continuous use of MPS. Additionally, unlike in previous studies, effort expectancy was not significant. This finding suggests that the perceived privacy risk, not the complexity of the service or difficulty in using it, could be a major hindrance in MPS adoption and diffusion.

Third, multiple group analysis showed that gender moderates two paths in the model. Facilitating conditions had a significant positive effect on the intention to use MPS for males but not females, as it is typically the nature of men to utilize efforts to deal with a problem on their own, therefore requiring available resources and knowledge to be used in their efforts.[52] This result suggests that not only the degree of technical resources or knowledge but also whether the consumer tries to solve the problem on his or her own or relies on others should be considered in solving technical

problems. On the other hand, the privacy risk had a significant negative effect on the intention to use MPS for females but not males. This finding shows a gender difference in perceiving the privacy risk, which is consistent with previous studies[36,50,51], and there is also a difference in the intensity of the negative effect of the privacy risk on consumer behavior according to gender. Considering the results of previous studies, in which there was no gender control effect in the model adding perceived risk to the UTAUT model[40,41], it is necessary to identify the different types of risk perceived by the consumer as in this study. Practically, these results suggest that different communication approaches are needed by gender when promoting MPS operations. For men, the use of MPS may increase if technical support or information is provided, while lowering the perceived privacy risk is more important for women.

6. LIMITATIONS AND FUTURE RESEARCH

Although this study divided consumers by gender, consumers can be categorized into multiple other groups using various criteria. Venkatesh et al.[20] suggested that past experience and the voluntariness of use can moderate the influence of independent variables on users' acceptance of technology. Garrett et al.[52] found that the lower the age, the higher the acceptance of mobile payments. Therefore, in future studies, it is necessary to identify different consumer segments in the use of MPS by examining the moderating effects of the various factors.

Another possible extension of this study could be dividing use by different consumer groups. The data for this study were only collected from South Korea; thus, the findings may not be generalizable to other geographical and cultural areas. Because perception and attitudes toward technology have been reported to exhibit significant differences by age, cultural background[53], and basic personality traits[54], verifying the validity of a research model and analyzing the differences according to these variables would be meaningful in future research.

7. ACKNOWLEDGEMENTS

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9. APPENDIX

Construct	Measurement Items
Performance expectancy	Using MPS saves time for payment.
	With MPS, payment is useful at the time of purchase.
	With MPS, the hassle of payment is minimized.
Effort expectancy	Learning to use MPS is easy for me.
	Using MPS is not difficult for me.
	I can easily become skilled at using MPS.
Social influence	People who influence my behavior think that I should use MPS.
	People who are important to me think that I should use MPS.
	There are many people around me who recommend using MPS.
Facilitating conditions	I have the resources necessary to use MPS.
	I have the knowledge necessary to use MPS.
	A specific person (or group) is available for assistance with MPS difficulties.
Privacy risk	By using MPS, I am at risk of infringement of my privacy.
	By using MPS, I am at risk of my personal information being collected excessively.
	By using MPS, my personal information is at risk of being accessed by unauthorized people.
	By using MPS, my actions are at risk of being tracked and monitored.
Intention to use MPS	I am willing to use MPS in the future.
	I will use MPS more often than now.
	I will use MPS more actively than the usual payment methods.